

# Analyzing the effectiveness of factors affecting online examinations of private universities in Sri Lanka using the addie model

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**Abstract-** Digitalization has resulted in a plethora of different innovations that exist all around and in turn has given us humans a vast area to improve and innovate. With the great variety of tools available to access information through any device anywhere anytime, higher education has also been a sector affected, leading way to the concept of online learning. The biggest challenge in the digital era is making use of this technology to provide anywhere anytime education to students. Online examinations are a popular form of assessment in online education of higher educational institutions. The increased popularity of online education in this century, has paved its way into investigating how effective examinations are in the process – specially in highly technical specializations such as IT (IT). This study reviews the determinant factors for the effectiveness of online examinations of IT undergraduates in private universities of Sri Lanka and measures its effectiveness using the ADDIE (Analyze, Design, Development, Implementation, Evaluation) Model. This study was conducted among examiners of private universities in Sri Lanka. A sample of 100 examiners belonging to four different private universities in Colombo were selected for the survey. Statistical analysis was done using IBM SPSS Statistics software. The research aims to introduce a model that would aid examiners in setting up more effective online IT examinations for undergraduates of private universities in the country.

**Index Terms-** Online examinations, Higher education, Online learning, IT undergraduates, ADDIE Model

## I. INTRODUCTION

The twenty first century has paved way to the development and vast use of IT. This has affected domestic life in numerous ways. IT and its developments are more of a part and parcel in our lives, be it at home or at work.

IT has drastically changed from merely being a prestigious luxury to a necessity in life [1]. The use of IT has become paramount for the organizations in their survival and the growth of the organization [2].

With the great variety of tools available to access information through any device anywhere anytime, higher education has also been a sector affected, leading way to the concept of online learning.

With the recent development of COVID-19 and its impact, higher education institutions continued to provide the students with the education services despite the many issues and challenges faced. The entire education platform in Sri Lanka moved online bringing in anytime anywhere any device access to thousands of students across the island. As the investments for digital learning significantly increased over the last few months, decisions were also made to move examinations online in order to allow the students to write exams from home, thus preventing a hampering in their education.

The study introduces a new model that would support examiners in setting up effective online examinations for undergraduates.

It has been drawn from literature that a major concern had been given to online lecture delivery and the implications of online lecture delivery. Few studies had been conducted on the effectiveness of online examinations for evaluating the student with high accuracy. It could also be drawn from literature that a majority focused on the student perspective when testing for effectiveness. However, this study will focus on the examiner perspective and the effectiveness when it comes to setting up online examinations.

The objectives of the study include; a) to analyze the evaluation criteria for IT undergraduate students in online examinations, b) to analyze the examination methodologies for IT undergraduate students in online examinations, c) to shed light on higher education evolution with the introduction of online learning in private universities of Sri Lanka and d) to make use of the ADDIE Model to evaluate the quality and efficiency of online IT examinations.

However, this study only focuses on private universities in Sri Lanka. In terms of data gathering, the study is limited to that of a questionnaire due to the COVID-19 outbreak although several other previous studies had been conducted via an approach of different data gathering techniques including interviews, observations and control experiments.

## II. BACKGROUND AND RELATED WORK

### A. BACKGROUND

This analyses the significant literature extracts that include the key concepts of achieving of learning outcomes, examiner perception

of assessments, tools used for online exams, misconduct detection methods, the effectiveness of online examinations and the technological know-how of examiners.

## B. RELATED WORK

### *B.A. Type of Question*

A literature review had been penned by Boitshwarelo et al. in [3] on envisioning the usage of online exams for administering the assessments of the learning process of the present century. An online examination contains different formats of questions including multiple choice questions, questions that require matching, a set of questions that requires selecting true or false as the answer, and also questions that require short answers. A paper that was reviewed by the authors, which had been penned by Simkin and Kuechler [4] stated that MCQs are considered the mostly used form of questions in online exams. Boitshwarelo et al. reviewed a paper that had been penned by Davies [5] which states that multiple choice questions can have a format that can vary from the recalling-type questions to those which would require an engagement of higher cognitive skill. The online exams can be used to generate a complete effect when made use of it in with the other forms of assessment [6]. There is evidence available to show that “multiple-choice testing all too frequently does not incorporate, encourage, or evaluate higher-level cognitive processes and skills” [7].

Birenbaum and Tatsuoka in [8] have penned a paper to examine if there would be a difference in outcomes for open-ended questions and MCQ format. The study was done by distributing a paper in arithmetic to 285 students of grade 8. Here, 148 of the students were given the test that contained open-ended questions and 137 students were given the MCQ paper. The two datasets were contrasted with deference with the fundamental construction of the test, the quantity of various blunder types, and the analyzed wellsprings of bugs reflected in the reaction designs. The general outcomes demonstrated extensive contrasts between the two formats, with more positive outcomes for the open-ended structure.

### *B.B. Examiner Perception of Assessments*

It has been mentioned by Robles and Braathen in [9] that an instructor would require the academic competence in the course content before he or she develops an effective assessment tool. It is mentioned in the article that in order to be an effective online educator, the educators should explore the ways that are required for the demonstration of the fact that the student learning had occurred. The article also brings out that in order to measure the objectives and the aims, the use of one particular assessment technique would not be sufficient. In order to make an online assessment, particularly one that is effective, assessment measures should be expanded by the instructors.

Different studies that have been done on the conceptions of the teachers and the assessment practices that were conducted in six selected countries, have been reviewed by Azis in [10]. The complexities of an effective learning and teaching process relate to the personal conception of a teacher and the theory of the teaching practice [10]. Whatever the type of assessment it is, a

teacher is portrayed as the main character in a learning process and thus in turn becomes the first interpreter of the information that is related to the assessment. Therefore, it is of importance the investigation of the conception of the teachers with regard to the assessments and how they use it.

### *B.C. Tools used for online exams*

Sun and Chen in [11] reveal that in order for the online education to be an effective one, the presence of a faculty with a high quality is highly essential and necessary. The authors also mention that the online faculty would need an adequate training of the many technologies that are applicable and are used in the process of online teaching. This training includes how the online system and the course software are used.

Pang et al. in [12] pen a research that discusses a training done in the online format and an examination system that was implemented and that which was based on web services. The system consists of five different modules. The design idea along with the architecture of the system used for the examination and also the methods that can be used to enable a live version of the system are spoken of in detail on the paper by Pang et al.

### *B.D. Misconduct Detection Methods*

Cluskey Jr et al. in [13] state that universities require proctors for exams and point out the inefficiencies including the cost and the time undertaken to identify and approve one. The authors pen that this cost undertaken exceeds the benefits. They pen an alternative solution for same, which is a proctor-less one. This could make it difficult, almost close to impossible, for students to cheat.

Harmon and Lambrinos in [14] pen on the topic of whether the online examinations are an invitation for the students to cheat. In the study, authors make use of data from two online courses belonging to the subject of economics. They use this data to make an estimation model which predicts examination marks from the independent variables belonging to the characteristics of the student. Final examination paper was proctored in one of the courses, while it was not in the other. In both the above-mentioned courses, the three exams given before were not proctored. Their findings were such that cheating took place where the examinations had not been proctored.

### *B.E. Technological know-how of examiners*

Ertmer and Ottenbreit-Leftwich in [15] pen that although technology increase, it has not been put into use. The paper talks of the integration of technology using the teacher as the change agent. Four variables are discussed here: self-efficacy, knowledge, subject, culture of school and pedagogical beliefs. The drawbacks are also discussed in relation to the professional development programs and teacher education.

### *B.F. Achieving of learning outcomes*

Zlatović et al. in [16] pen out 2 goals; the first being the influence of e-assessments on the strategies of learning of students and also the influence of the strategies on the student results. The research was done on 351 university students. Findings could be used in the creation of new and improved assessment system that is done

online. The creators in this paper to examine the impacts of declaring and settling particular sorts of online information evaluations on incitement of students' profound and surface learning and accomplishment of required learning objectives. Information evaluation is a significant part during the time spent accomplishing wanted learning objectives among understudies. Other than the undeniable job of evaluating understudies' information, research proposes that online information appraisals have a few extra significant jobs with regards to online schooling: (i) to invigorate the learning interaction in basic spots of online courses, typically containing seriously requesting content, and (ii) students and also the influence of the strategies on the student results. The research was done on 351 university students. Findings could be used in the creation of new and improved assessment system that is done online.

#### B.E. Research Gap

It could be viewed from the literature that was reviewed, that major concern had been given to online lecture delivery and the implications of it. Few studies had been conducted on the effectiveness of online examinations for evaluating the student with high accuracy. Studies done in modules belonging to IT have been done in developed countries where technology stands advanced. Also, it could be drawn from reviewed literature that a majority of them focused on the student perspective when testing for exam and course study effectiveness.

Therefore, it could be concluded by looking at all this, that the current study has been undertaken to focus on a rather more developing country as Sri Lanka, for IT undergraduates of private universities in Colombo, where online education is yet another developing component in the field of education and where students from all parts of the country enrolls in and should be facilitated.

### III. METHODOLOGY

The research onion model has been utilized to carry out the research study.

Data collection has been done through both primary and secondary sources. Questionnaires were distributed amongst examiners of selected universities in, Sri Lanka, to determine the factors. The questionnaires used for data collection consist of both close-ended and open-ended questions, and distributed electronically. Secondary data had been collected from websites, articles and research papers. Secondary data was collected to establish theoretically support in proving and defining literature and relationships between variables.

The population of this research study are the examiners of IT undergraduate students. The research instrument of the study is the questionnaire. Questionnaires were distributed online. The pilot survey was conducted for 20 examiners. The sample size of the final survey is 100.

Data analysis has been done using IBM SPSS Statistics software. The data is analyzed through regression and descriptive statistical methods.

A longitudinal time horizon has been used when gathering the data. One questionnaire determines the factors initially. After a comparison and contrast with the ADDIE Model, a new model is

be developed accordingly. The factors pertaining to the new model are tested for effectiveness through a questionnaire distributed to 30 members belonging to the same sample.

The research incorporates both the quantitative and qualitative research methodologies. Qualitative analysis has been done through a compare and contrast of the determinant factors with the ADDIE Model, and a quantitative analysis had been done to measure the dependency of the variables presented.

The strategy used for the research is a survey. Inductive approach is used for the research wherein a new model is introduced, that examiners could make use of in setting up more effective online examinations for IT undergraduates.

### IV. RESULTS AND DISCUSSION

#### A. Results

A 95% confidence interval has been utilized for the study. The research considered 6 hypotheses and aspires to establish a positive relationship between the independent variables and the dependent variable.

Through the Cronbach's Alpha values depicted by Table 1, it could be depicted that the statements of each of the variables are reliable.

Table 1 Cronbach's Alpha Values

Variable	Cronbach's Alpha
Achieving of learning outcomes	0.798
Perception of Assessments	0.792
Type of Question	0.709
Misconduct Detection Methods	0.694
Tools used for online exams	0.769
Technological know-how of examiners	0.779
Effectiveness of examinations of online education in IT Undergraduates	0.799

It could be stated that items of the variables are consistent. The KMO (Kaiser Meyer Olkin) value is 0.635 which resulted in an acceptable for a factor analysis to proceed with. The Sig. value of the Bartlett's Test of Sphericity resulted in being able to reject the null hypothesis that the correlation matrix is an identity matrix and thus making the variables ideal for factor analysis.

The normality test was done on each of the variable responses. The one-sample t-test was done on the continuous independent variables and the dependent variable. The p-value of all variables showed a value of almost close to 0.00. This rejects the null hypothesis for each of the variables indicating that the data readings are strong and they are not by chance. A one-way ANOVA test was done to determine the variable batch size since the independent variable is a categorical variable. In this research, all the independent variables that have been considered through the Pearson Correlation are positive to the dependent variable. Also, all the independent variables have a correlation is which is significant at the level of 0.05.

The regression analysis and the moderation analysis were conducted thereafter. Achieving of learning outcomes has a significant positive relationship on the effectiveness of online

exams, thereby the hypothesis pertaining to achieving of learning outcomes is accepted. The hypothesis of examiner perspective of assessments is accepted. Results showed that the type of question significantly impact the effectiveness of online exams. Hence the hypothesis was accepted. The hypothesis pertaining to the misconduct detection methods was accepted. A negative relationship between the size of the batch and effectiveness of online exams was identified, thereby arriving at a statistically insignificant relationship between these two variables. Hence the hypothesis can be rejected. The moderating variable of the tools used is the technological know-how of examiners. It was seen that although the independent variable has a positive significant relationship with the effectiveness, the moderating variable individually, has a positive insignificant relationship with the dependent variable, and the interaction of the tools used with the technological know-how, shows a positive insignificant impact on the dependent variable. Therefore, the hypothesis is rejected. Results show that the batch size and the technological know-how of examiners have no effect on the effectiveness of the online exams given to IT undergraduates.

In this research the explanatory power or the extent to which the dependent variable is being explained by the independent variables is 0.302 (adjusted R square) which can be expressed as 30.2% as a percentage.

Based on the results, the conceptual model was updated as shown below in Figure 2.

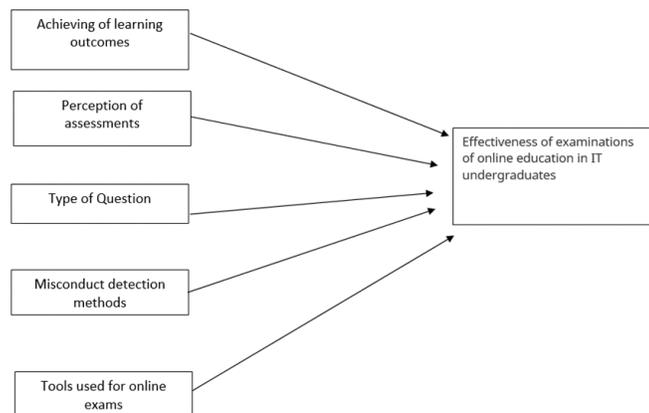


Figure 1 Updated Conceptual Model

In this research the explanatory power or the extent to which the dependent variable is being explained by the independent variables is 0.302 (adjusted R square) which can be expressed as 30.2% as a percentage.

A qualitative analysis of the above conceptual model and the ADDIE model with the aim of creating a new framework that would support examiners in setting up effective online examinations for IT undergraduate students in the field of Information Technology.

The model used for the qualitative analysis of the study is the ADDIE model. The above model is an ISD (Instructional Design)

model. This model is used for organizing and for the purpose of streamlining a course content [17]. The model had been utilized in the creation of online course content [18]. This study compares the model derived with the above-mentioned model to create a framework that could be utilized in the setting up of effective online examinations for IT undergraduates.

The undertaken research study contains a model that contains the following; the tools used, the perception of assessments of the examiner, the type of question, achievement of the learning objectives and misconduct detection methods.

Similarities could be seen in the models. The perception of assessments of the examiners of the current study can be compared to that which occurs in the Analysis phase of the ADDIE model. The Design phase of the ADDIE model contains functionalities of identifying and specifying the learning objectives of the course and designing of the interfaces which are two variables found in the study that could have a positive impact on the effectiveness of online exams of IT undergraduates, tools used and achieving of learning objectives. The utilization of various misconduct detection methods and question types for each of the exams is similar to that of the Development phase of the ADDIE model.

A questionnaire was distributed amongst a group of 30 IT undergraduate examiners in order to get feedback on the model introduced. The responses were collected after briefing the 30 selected examiners on the framework introduced. The feedback taken on the newly introduced model was given more of a positive opinion by the majority.

### B. The Model Introduced

A new framework is proposed to effectively set up effective online examinations for IT undergraduates.

The steps are as mentioned.

1. **Outline** the learning objectives of each of the modules taught and the general academic performance of the students in a batch. Also, analyze the curriculum and decide on exam categories that are given in the form of online mode.
2. **Identify** the question types that would match the exam categories and the tool that would be used to give the students the exam. (The exam tool will depend on the objectives of the exam given and the misconduct methods that are decided to be used by the institute.)
3. **Design & Develop** the questions taking into consideration the time duration for the exam paper in general and keeping an estimated time duration for each question in mind. This phase contains the decision of how the exam questions will be displayed at the exam and if question randomization exists.
4. **Administer** the exam to the learners and test for its effectiveness.
5. **Assess** the achievement of the learning objectives of the module after the student answer script evaluation.

### C. Discussion

The four main research objectives are achieved through the literature review conducted and also through the analysis of the primary data that was gathered through the use of the research instrument which is the questionnaire. Therefore, the evaluation of

the four objectives is conducted with the use of the two components, literature and statistical tests as the main basis for the it. Further, it could be stated that the research study has accomplished the set objectives.

#### **Objective 01 - To analyze the evaluation criteria for IT undergraduate students in online examinations**

The first objective was to analyze the evaluation criteria for IT undergraduate students in online examinations. Through the research study conducted, it was observed that the evaluation criteria for online examinations slightly deferred from that of paper-based examinations since plagiarism checks were taken into consideration before the marking of the examination paper. Through the survey it was observed that most online examinations were MCQ-based, thus, having criteria for marking of the papers was not required. However, examiners also responded to the question of how exam papers were marked. Of the respondents, 40.9% responded that marking was done manually and 18.84 % responded that marking was done on-screen which requires them to prepare evaluation criteria for same.

#### **Objective 02 - to analyze the examination methodologies for IT undergraduate students in online examinations**

The second objective of the study was to analyze the examination methodologies for IT undergraduate students in online examinations. It could be seen through the survey conducted, that private universities have moved their undergraduate level IT examinations to an online platform, partly or completely. 70% of the respondents stating that they completely use online methodologies for exams and 30% using both. 4 respondents stated that their midterm exams were in only mode. 78 of the respondents stated that final exams were in online mode. 51 and 38 of the respondents responded that coursework submissions and CA submissions happened in online mode respectively. Final year projects happen online according to 35 respondents while 14 stated that take-home exams were in online mode. It could be concluded from the above analysis that private universities in Sri Lanka use online methodologies for conducting IT undergraduate level exams.

#### **Objective 03 – To shed light on higher education evolution with the introduction of online learning in private universities of Sri Lanka**

Objective three was to shed light on higher education evolution with the introduction of online learning in private universities of Sri Lanka. It was depicted from the survey conducted that private universities in the country have partially or fully moved their education platform to online mode. It could be viewed from the responses of certain examiners that the matter of concern with some systems they use was the reduced use of misconduct detection methods. 46.85% stated that online exams are not checked for plagiarism issues. The respondents were also asked to rate the systems that they use for online exams, out of a maximum possible 10. A majority of them rated a 7 for their respective systems. It could be concluded and stated from the above statistics that the future of higher education is in good hands in the area of online education and online examinations given that universities improve and extend methodologies to prevent fraud at examinations.

#### **Objective 04 - To make use of the ADDIE Model to evaluate the quality and efficiency of online IT examinations**

The fourth and final objective of the research was to make use of the ADDIE Model to evaluate the quality and efficiency of online IT examinations. ADDIE model contains 05 phases. The analysis phase identifies the objectives, the needs of the audience and the learning environment. The learning objectives are specified in the Design phase. Here, the content as well as the interfaces are designed. The content production is done in the Development phase and during the Implementation phase, the training procedure is developed, content is delivered to the learner, and effectiveness of the material is then evaluated. The final phase measures how well the objectives are achieved. It was viewed from the survey analysis that a majority stated that the online exams that are constructed help analyze whether the students can make best use of the taught content and if they could use the skills that were learnt in the classroom environment, when writing the exams. It could be stated that the Analysis phase of the ADDIE model is covered here since the requirement of the students is identified here. A majority of the respondents stating that the online exams that are constructed by them cover the learning outcomes of their respective modules. This fits into the Design phase of the ADDIE model. The exam question production, including which exam types to be moved online, the question types and the method of displaying the paper to the students fit into the phase of Development of the ADDIE model. The students facing the online examination fits the Implementation phase of the ADDIE model. However, the Evaluation phase of the model does not seem to have been covered in the online examination process. The examinee's opinion, views and feedback about given exam papers need to be taken just as it would be done at the end of a course delivery. This could be done from the examiner's perspective too through the exam administration divisions. This ensures that the learners are satisfied with the system and the examiners are confident and satisfied with the various options available on the system for question creation and misconduct detection. Else, the system can be updated and enhanced to satisfy not only the examinee but also the examiner. In turn, it could improve the quality and efficiency of online IT exams of undergraduates.

#### **V. CONCLUSION**

It could be concluded that the current study has been undertaken to focus on a rather more developing country as Sri Lanka, from the perspective of examiners of IT undergraduates of private universities, where online education is yet another developing component in the field of education and where students from all parts of the country enrolls in and should be facilitated.

The model introduced could be used to support examiners in setting up online examinations for undergraduate students in the field of IT and in turn, help in creating a new and improved higher education platform in the country.

The study could further be expanded in the following ways.

- The study could be expanded to focus on the undergraduates in other areas of study.
- The study could also be expanded to focus on the examinations conducted for the undergraduates of state universities.

- The study can expand to cover the effectiveness of examinations of IT postgraduate students in both state and private universities in the country.

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